Anatomy of a Technology Transfer: The National Commission on Libraries and Information Science Literacy Project

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Introduction

THE NATIONAL COMMISSION ON LIBRARIES and Information Science (NCLIS) is a permanent and independent agency established under Public Law 91-345 on 20 July 1970. Its mandate is to recommend policies and plans to the president and Congress for the provision of library and information services adequate to meet the needs of the people of the United States. NCLIS is authorized, among other things under the law, to "make and publish such additional reports as it deems to be necessary, including, but not limited to, reports of consultants, transcripts of testimony, summary reports, and reports of other Commission findings, studies, and recommendations."

The programs of the commission are driven by a continual assessment of the library/information needs of the country and in implementing its programs NCLIS plays one of four roles: (1) as *resident expert* in the library/information field to advise the executive and legislative branches of the federal government; (2) as an *honest broker* bringing together representatives of all branches of the government to focus on matters of common interest and to develop recommendations to solve existing problems; (3) providing a *forum* for the library/information community, both public and private sectors, at all levels of government—federal, state, and local; and (4) as a *catalyst* to accelerate change.

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Literacy and NCLIS

The commission has long had an interest in the question of illiteracy in that it is the belief of the commission that illiteracy creates a barrier to access of information. In its program document, *Toward a National Program for Library and Information Services: Goals for Action,* this ideal is stated:

> To eventually provide every individual in the United States with equal opportunity of access to that part of the total information resource which will satisfy the individual's educational, working, cultural and leisure-time needs and interests, regardless of the individual's location, social or physical condition or level of intellectual achievement.[1]

Therefore, there is a place for libraries in the schema to raise the reading levels of those persons deemed illiterate in order that they may gain access through the library to the information they need to govern their lives.

In April 1979, as a response to the recurring issue of literacy at state-level governor's conferences prior to the White House Conferences on Library and Information Services, the Theme Conference on Libraries and Literacy was held in Reston, Virginia. Two hundred representatives from the library and educational communities and from government, business, and the private sector met to consider the question of illiteracy and prescribe roles for federal, state, and local governments and libraries to join in the fight against illiteracy. The recommendations from this theme conference were incorporated into the deliberations of the delegates at the 1979 White House Conference on Library and Information Services (WHCLIS) and resulted in Resolution A-4 passed at the conference.[2]

NCLIS and the Department of the Army

In its ongoing process toward implementation of recommendations from WHCLIS, NCLIS staff felt there were research and development projects conducted by the military in the area of reading improvement, and that some of these projects might be suited to a technology transfer that could be utilized by libraries having literacy education programs.

A meeting was requested with E. Jack Kolb, principal technical information officer, U.S. Army Matériel Command Headquarters, for the purpose of seeking assistance in locating suitable projects. Kolb had been a participant in the WHCLIS and was known to have an interest in the area of literacy improvement. He arranged a meeting for NCLIS staff with Donald O. Egner, chief, U.S. Army Human Engineering

Laboratory, to discuss the matter as Egner was currently involved in a reading improvement program with the Baltimore County Department of Education. As a result of the meeting with Egner, a decision was made to establish a steering committee (see appendix) to look at the problem and discuss strategies for accomplishing the task.

Action Steps

Definition of the Problem

The first meeting of the steering committee was 15 June 1983, at which time participants were asked to focus on what can be done by libraries to utilize research and development (R&D) projects developed by the military to increase literacy among adult Americans; briefed on technology transfer and the "Stevenson-Wydler Technology Innovation Act of 1980" (PL 96-480)[3]; presented with general information on some reading programs developed by the Department of Defense (DOD); and shared background information on literacy and their individual and organizational expertise in the area of literacy improvement.

After much discussion the problem was defined as, "What can be done by sharing and transferring technology developed by the Federal Laboratories Consortium when this technology is to be used by volunteers and others in cooperation with libraries and information facilities to increase literacy among out-of-school teens and adults whose basic skills are between zero and fifth-grade level?"

Problem-Solution Strategy

It was agreed that the group needed more information about projects on "adult learning programs" developed for use by the military and, if possible, demonstrations of the most likely programs for a technology transfer. Egner and Promisel volunteered to continue the search for additional DOD R&D projects. In addition Egner would tap the Federal Laboratories Consortium[4] for recent or in-progress projects. Literature searches were to be performed on the National Technical Information Service and Defense Technical Information Center databases and in *The Network: The Military Educator's Resource.*

The group was aware of numerous commercial packages available, but feedback where these had been used with adults was that the juvenile content "turned off" the students. Therefore the content of any reading program to be considered by the group would have to appeal to the adult learner. The literacy service provider, "Jinx" Crouch, and the literacy librarian, Jane Heiser, agreed to investigate possible sites where the

technology selected might be transferred and to identify potential constraints. NCLIS staff would furnish an independent viewpoint upon examination of the possibilities of the application of technology transfer to the sites.

Information Analysis

The committee reviewed the literature searches and examined the reports from Egner and Promisel on the following adult learning programs developed by federal R&D laboratories:

—Functional Literacy (FLIT)
—Hand-held Vocabulary Tutor
—Language Skills Computer Assisted Instruction (LaSCAI)
—Basic Skill Education Program
—Spatial Data Management System (SDMS)
—Air Force Reading Proficiency Program

The group decided that the most promising prospects were two army programs—Spatial Data Management System and Hand-held Vocabulary Tutor—and the Language Skills Computer-Aided Instruction program developed by the Naval Personnel Research and Development Center, and it requested demonstrations of these. Demonstrations of the three programs revealed the following:

Hand-held Vocabulary Tutor. The hand-held vocabulary tutor was a battery-operated portable device with a liquid-crystal display of thirty-two characters and an abbreviated keyboard. It contains a Texas Instruments basic microprocessor for synthesized speech which is coordinated with an illustrated booklet to train military recruits in the special vocabulary of the Military Occupational Specialty for the Cannon Crewman. The committee felt the device had merit because of its portability and speech capabilities, but overcoming the cost of having a special cartridge developed for the speech synthesis posed a big problem.

Spatial Data Management System. The Spatial Data Management System was an interactive videodisc instructional program to increase basic skills among military recruits. Several modules had been designed to teach (1) navigational and map-using skills, (2) using a table of contents, and (3) test-taking strategies.

The committee agreed the SDMS was excellent for individualized programmed instruction, but the initial cost for creating a videodisc for the purpose of teaching basic reading skills would be prohibitive. Also, the cost and availability of the equipment needed would place the program beyond the reach of the libraries for whom the technology

transfer was intended. Moreover, there could be no adaptation to the SDMS program for the committee's purposes.

Language Skills Computer-Assisted Instruction. LaSCAI was a computer-assisted instruction (CAI) program developed to provide remedial instruction in technical vocabulary and technical reading for navy recruits using content material from navy recruit training manuals. The program performs various exercises on a dictionary of words and a set of related paragraphs to improve and teach: (1) spelling, (2) literal word definitions and usage, (3) sentence structure and content, and (4) comprehension and paragraph flow. LaSCAI was developed for use with the Apple II Plus personal computer but could also be used on a standard Apple IIe. The program had been implemented on the IBM personal computer.

The committee felt that LaSCAI offered the most promise for a technology transfer for the following reasons:

1. The program used the computer to more advantage than the average computer-assisted instruction.
2. The program was designed for a microcomputer that is generally available in public libraries and is within a cost range reasonable for public library application. The program could be modified to run on other microcomputers.
3. The authoring utility permitted the tailoring of instructional material in any content area specific to meeting the needs of targeted groups that would be identified by the tutors and students.
4. The authoring program was available from the Office of Research and Technology Assessment for the U.S. Naval R&D Center.
5. An evaluation of navy personnel using the program revealed a faster learning rate, longer retention rate, and improved literal comprehension skills that exceeded those acquired via a standard classroom approach.
6. Being a CAI program, more students could be handled without increasing a library's staff, number of volunteers, time required, or resources.

The committee then decided that a demonstration project using LaSCAI in a library literacy program would be appropriate in order to test the technology transfer problem.

Site Selection

It was determined that two sites, one urban and one rural, would present the best proving ground because of the varied nature of their

clientele. In order to facilitate monitoring the project it was decided that the sites should be close to Washington, D.C.

The Literacy Resource Center of the Enoch Pratt Free Library in Baltimore, Maryland volunteered to become the urban site as it had the necessary hardware, a volunteer component already in place, and a ready pool of potential students. The Mary H. Weir Library in Weirton, West Virginia had heard of NCLIS's activities and asked to become the second site. The Weirton Area Literacy Council had received a grant from the Appalachian Regional Council to establish a Community Computer Communication Center for adults and out-of-school youth sixteen years and over residing in the city of Weirton, and in Hancock and Brooke counties. The center would give these persons the opportunity to learn about computers while improving their reading, writing, and computational skills necessary for training and employment. The center was to be based in the library and the library had an ongoing literacy education program.

These two sites appeared to be excellent for demonstration purposes because (1) the literacy tutors at the Baltimore site were trained in the Literacy Volunteers of America technique while those tutors at the Weirton site were trained in the Laubach method. This would permit the use of LaSCAI by persons trained in two differing methodologies of literacy tutoring; (2) the Weirton site, while not close to Washington, D.C., was close to Pittsburgh and the Carnegie-Mellon University where Dr. Thomas Duffy—who played a major role in the project—was based; and (3) Weirton, while not "rural" in the classic sense, was nonmetropolitan.

The Demonstration Project

The project was conducted as an open entry/open exit demonstration rather than a controlled demonstration due to the history of high attrition rates that accompany volunteer literacy programs. The focus of the evaluation of the project was on qualitative methods—i.e., the values that the tutors and students place on the LaSCAI program. For this, the tutors and students would be interviewed before and after the demonstrations to reveal their attitudes toward literacy, tutoring, computers, and the LaSCAI program in general.

The goal of the project was to find the problems that arose as volunteer tutors used LaSCAI with their students and to formulate strategies for dealing with those problems. The project had four phases: (1) review of materials developed for use with LaSCAI; (2) initial interviews of students, tutors, and staff who would be involved; (3) observa-

tion of tutors and students using LaSCAI during the course of the project; and (4) follow-up interviews of all participants.

Workshops were conducted by Thomas Duffy—one of the developers of the LaSCAI program. At each site he introduced the program to staff and volunteers; gave an explanation of the philosophy underlying the program, provided hands-on experience with the program; discussed strategies for developing units of instruction, and gave ways to integrate the CAI with the regular tutoring. The project began at the Baltimore site in October 1984 and ended March 1985. At Weirton, the start date was December 1984, and May 1985 was the ending date.

Development of Materials

Tutors were asked to select one to three content domains having subject matter relevant to daily life and of interest to the students, and the tutors were also asked to submit three units of instructional material to Duffy for editorial feedback. Using the detailed comments and illustrations, materials were revised by the tutors and the final versions submitted to Duffy at Carnegie-Mellon University for programming onto diskettes.

Enoch Pratt Free Library. The librarians at the Baltimore site assumed full responsibility for defining the content domain, identifying relevant materials, and developing units of instruction. Focus was placed on identifying materials that would be of most interest to and meet the needs of the neighborhood. Having substantial experience managing and tutoring in the library's literacy program, the librarians based their judgment on their knowledge of people's requests upon coming to the library for help with particular tasks for which reading is essential. The domains selected for developing materials were "Preparing Your Income Tax Return," "Getting Your Driver's License," and "Consumer Protection."

Mary H. Weir Library. The tutors were given the sole responsibility for determining the content domain, and as each individual tutor was interested in the needs of his or her individual student, this created a problem in the narrow views entertained. There was little agreement as to what the students "should" or would want to read. When asked to focus on a functional topic, the answer was usually too specific—e.g., chicken farming—to have general applicability to a larger audience.

Negotiation resulted in the compromise selection of "Money Management" as the content domain, the rationale being that learning more about money management would be beneficial to all students in that economically depressed section of the country. A later suggestion to

develop materials to parallel the Laubach text being used was enthusiastically received and an additional unit was then developed to accompany Laubach Book 4.

Demographic Data

Tutors. Eleven female and four male tutors took part in the demonstration. They ranged in age from the early twenties to the early seventies with the median age being forty-four years at the Baltimore site and thirty-nine at the Weirton site. All but one tutor had received twelve to sixteen hours of tutor training and had tutored at least one student prior to the start of the demonstration. Four tutors had prior school teaching experience, but none had experience or training in teaching reading.

Students. Five male and ten female students started in the demonstration project. The median age was late twenties. Three students were nonnative speakers of English and they were at the Weirton site.

Students at both sites were given the ABLE reading test—level 1, 2, or 3—to assess their reading ability. The mean grade-level reading score at the urban site was 7.6 and it was 4.1 at the nonmetropolitan site. The median length of previous experience in literacy tutoring was 0.25 months at the urban site and 4.75 at the nonmetropolitan site. Of the students at the urban site 67 percent reported having attended other tutoring or adult education programs. At the nonmetropolitan site 25 percent of the students gave a similar answer.

Student Preinterviews

Seven students at the Baltimore site and eight at the Weirton site were questioned about their experience with and interest in computers; why they wanted to read better; if they felt computers would help them read better; and their views on student-tutor relationships. Students at both sites voiced a limited experience with computers and were interested in learning more about them to help their children who would be using computers in school, and as a possible lead to jobs using computers.

The students' reasons for beginning tutoring differed at the two sites. The Baltimore students stated they felt tutoring in reading would help them improve themselves in a general way, viewing reading as a means of social and economic advancement. The Weirton students' responses were more job-oriented—to help them advance in their present jobs or enable them to read application forms well enough to obtain jobs. All students felt that reading was more than being able to decode words since they experienced trouble understanding what they read

even though they could read the words. Students at both sites voiced the need to read better in order to help or keep up with their children.

The students were unable to imagine what learning to read with a computer would be like having no prior experience. They had reservations that the computer could not give affective answers and would be slower than a tutor in recognizing when a student was experiencing difficulty. The students cited the emotional support and encouragement given by tutors as the most important element in their success in reading.

Tutor Preinterviews

Seven tutors in Baltimore and eight in Weirton were questioned about their attitudes toward computers in society (resistance to change); their ability to integrate computers into their existing routines; and their understanding of LaSCAI and their plans for using it—i.e., separate or integrated with their tutoring, having the student use LaSCAI alone, or under the tutor's guidance. Generally, all of the tutors were accepting and optimistic about computers and the implications of the new technologies for education and for society at large. However, the tutors at Weirton—while citing increased efficiency and more accurate calculations as benefits from computers—also voiced their concern about the dangers of unemployment created by the increasing use of computers.

Most of the tutors felt that LaSCAI would be an entertaining way to introduce new vocabulary and the students would have "fun" using it. They also viewed the project as an introduction to computers.

The tutors at Weirton did not plan to integrate LaSCAI with the Laubach instruction but to use the two in parallel as they did not consider LaSCAI accomplishing the same goals as Laubach instruction. LaSCAI was seen as a motivational tool while the "real" instruction would be via the Laubach skill books. Baltimore planned to start the tutors with new students with LaSCAI being the focus of the instruction; ergo integration into an ongoing student-tutor relationship was not relevant.

All of the tutors except one indicated that they intended to sit beside the student during instruction. The exception opted to leave the student alone after the first session but be accessible during the session for necessary assistance and discussion of the unit at the end of each session.

On-Site Observations

On-site observations were designed to determine if the tutors were able to integrate the LaSCAI program into their tutoring strategies—

i.e., what assistance tutors provided students, what percentage of time the student spent working on-task, and what supplementary material tutors used with the program. The data collected would give evidence if using LaSCAI—or other computer-based literacy programs—would be cost-effective for volunteer tutoring programs.

Only two of the tutors—both having considerable experience teaching on the secondary level, tutoring several adult learners, and familiarity with CAI—left their students to work alone. In general, tutors conducted the computer-based sessions in much the same way as conventional sessions—i.e., sitting beside the student throughout the session, providing information, and answering questions.

Tutors were frequently observed offering students hints about correct answers. In two instances tutors wrote down the definitions and sentences in the LaSCAI exercises in order to prompt the student if the student appeared about to make a mistake. Students spent more time-on-task (working independently) during computer sessions than during conventional tutoring.

Tutor Post-Interviews

Several of the tutors voiced a change in attitude toward and acceptance of computers and CAI as a result of their experience in the project, no longer seeing them as a threat to replace the teacher or the tutor. They viewed the computer as another tool to be used in teaching. Seven of the tutors stated they would like to continue using LaSCAI while two said they "might" continue to use the program if bugs in the current program were eliminated.

Those tutors who had not let their students work alone felt that their students would be able to use LaSCAI on their own. None of the tutors or staff felt LaSCAI alone was a reading course in itself, but they saw it as an effective supplement. They maintained that personal contact was an important component of tutoring.

Four of the urban tutors reported using supplementary materials such as the dictionary, magazines, phonics worksheets, and booklets on content material similar to that on the LaSCAI disks. None of the tutors at the Weirton site reported using any supplementary materials while working with LaSCAI, though they frequently used such material when working with the Laubach books. The majority of tutors at both sites felt that tutors should not develop the instructional units for LaSCAI, but trained staff using suggestions from tutors and students should develop appropriate material. Tutors' suggestions included: having the opportunity to preview material in order to better prepare for the tutoring sessions; including more student writing exercises; needing

more training with LaSCAI before using with students; and providing a larger library of LaSCAI materials with topics of use and interest to students.

Student Post-Interviews

The original participants who were available—including those who were no longer using LaSCAI—were given post-interviews. These included two students at the Baltimore site and four at the rural site.

The students reported feeling quite comfortable working alone at the computer and mentioned some advantages to working alone—e.g., the ability to pace themselves and the feeling of privacy. The students also felt that the program alone was not sufficient to teach reading but was seen as a good supplement to their basic tutoring program.

Implications

The demonstration suggests that the LaSCAI program can be used cost-effectively in volunteer literacy programs that are library based only if it frees tutors and staff to work with new students. Several students could work at the LaSCAI program under minimum supervision by a trained tutor and alternate those sessions with one-on-one tutoring sessions. This strategy would double the number of students with whom a tutor could work.

Students must be allowed to work independently and tutors must be trained to use the program in ways that exploit the potential of the program. When tutors continue to work beside students, LaSCAI is not cost-effective.

Expertise and training in reading instruction are required to identify functional reading requirements and to develop the material for the LaSCAI program. The demonstration suggests that trained staff be responsible for developing materials. The demonstration suggests that tutors are agreeable to the use of CAI as supplemental to the reading program and not as a stand-alone program which it was never intended to be.

LaSCAI should not be viewed as motivational or "fun" thereby becoming a guarantee against attrition. Of the fifteen students who began the project, eight were still in tutoring at the end of the demonstration. Students will continue to drop out of CAI for the same reasons as they drop out of conventional tutoring—personal problems, ill health, family problems, job conflict.

Debugging is a standard requirement in the development of any software. LaSCAI, as used in the demonstration, had been directly

implemented from a research program without support or time for a debugging effort. Before other volunteer programs use LaSCAI it must undergo a debugging. Modifications and additions to the instructional program, as suggested by the tutors, might be accomplished at the same time as the debugging process thereby improving the overall effectiveness of LaSCAI.

Conclusions

1. The LaSCAI program developed by the Naval Personnel Research and Development Center can be used to advantage in a library setting utilizing volunteer tutors to increase the reading and comprehension levels of adult students.
2. Additional program modification and documentation is needed in order to extend the use of LaSCAI, without extensive personnel backup, to other libraries.
3. A single location is essential to administer the application of this program for other libraries, to serve as a clearinghouse for new materials developed, and to obtain resources to direct continuing R&D needed to improve and expand the utilization of the program.

Afterword

Extension of the project to the Pittsburgh, Pennsylvania area is under consideration. A cooperative proposal for a "Computer-Based Adult Literacy Instruction Program" drafted by the Carnegie Library of Pittsburgh, the Carnegie-Mellon University, the University of Pittsburgh, and the Greater Pittsburgh Literacy Council, calls for the development of a "magnet" literacy center to serve as a research and development site as well as a feeder point for delivery of services to four targeted library branches.

References

1. National Commission on Libraries and Information Science. *Toward a National Program for Library and Information Services: Goals for Action.* Washington, D.C.: USGPO, 1975, p. xi.

2. White House Conference on Library and Information Services. *The Final Report: Information for the 1980's.* Washington, D.C.: National Commission on Libraries and Information Science, 1979, pp. 46-47.

3. The Act states: "it is the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal Investment in research and development. To this end the Federal Government shall strive where appropriate to

transfer federally owned or originated technology to State and Local governments and to the private sector." U.S. Congress, House Committee on Science and Technology, Subcommittee on Science and Technology. "Stevenson Technology Innovation Act of 1980." 96th Cong., 2d sess., rept. no. 7, 96-1199.

4. The Federal Laboratories Consortium (for Technology Transfer) is composed of members from over 200 R&D laboratories and centers from 11 federal agencies. The consortium promotes communication between DOD laboratories and other agencies and maximizes opportunities for finding new and multiple applications for available and developing technologies.

Appendix

STEERING COMMITTEE

Helen, (Jinx) Crouch, Executive Director, Literacy Volunteers of America, Syracuse, New York.
June Eiselstein, Director, Mary H. Weir Public Library, Weirton, West Virginia.
Jane Heiser, Director, Literacy Resource Center, Enoch Pratt Free Library, Baltimore, Maryland.
David Promisel, U.S. Army Research Institute for Behavioral and Social Sciences, Washington, D.C.
Charlotte Purnell/John Painter, Delaware Technical and Community College, Georgetown, Delaware.
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